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without getting upon it. I have made a drawing-table upon the plan above described, and I find that I can get to any part of it with perfect ease. The table may be used in a horizontal or an elevated position, nearly to a perpendicular; when in the latter situation I hang the drawing-square over the upper edge of the drawing-table, and draw the lines perpendicular; and when long lines are wanted at right angles to them, I turn the board one-fourth round, and then draw the lines as before, which I find to be more perfect than drawing them in a horizontal position. I can place a much larger drawing-board on the stand than the one described and use it with perfect ease.

No. XV.

INSTRUMENT FOR MEASURING SMALL INTERVALS OF TIME.

The Gold Vulcan Medal was this session given to Mr. William Hardy, Wood-street, Coldbath-fields, for his Instrument for ascertaining 1-600*th part of a second of time. One of the instruments has been placed in the Society's repository.*

No. 5, Wood-street, Coppice-row, Spa-fields,
April 19, 1825.

Sir,

I beg leave to lay before the Society of Arts, a machine or time keeper, for reading off the three hundredth part of a second of time; it may be used for many purposes where accurate measurement of time is an object, such as the occultation of the stars, and the velocity of sound. This machine has been used by the officers of artillery at Woolwich for some years, and has been of great service in ascertaining the flight of their projectiles, as Dr. Gregory can testify.

I am, Sir,
&c. &c. &c.
WILLIAM HARDY.

A. Aikin, Esq.
Secretary, &c. &c.

Reference to the Engravings of Mr. William Hardy's Instrument for ascertaining small intervals of time.

Plate XII. fig. 1 is a view of the dial plate and hands.

Fig. 2 is a view of the back plate or frame, &c. without the case or box.

Fig. 3 is a view of the lower edge of fig. 2.

The same letters refer to the same parts of each figure. The wheel-work or movement of this instrument is nearly similar to that of a watch; the circle *a* on the dial plate, fig. 1, is divided into 60 parts; the hand *b* turns round in one hour, consequently each division indicates one minute. The large circle *c* is divided into 300 parts; the long hand *d* turns round in one minute, therefore five divisions are equal to one second, and each short division equal to one-fifth of a second. The arc *e* is divided into sixty, and each of them again subdivided, which will be the 120th part of a vibration of the hand *f*. The outside of the arc *e* is numbered from the right hand side towards the left, and the inside of it from left to right. The hand vibrates from 0 to 60, and makes one vibration while the hand *d* moves one division on the circle *c*, which is the fifth part of one second, and being multiplied by 120 makes 600; consequently one division on the arc *e* is equal to the 600th part of a second. The dotted circles in fig. 2 give the relative diameters of the wheels and pinions at the pitch lines, and the numbers of teeth in each are marked upon them: *g* is the first or large wheel, which is fixed on the end of the box that contains the main spring, the teeth of which work into the pinion *h*, not having any fuzee or chain, as in other watches; on the axis of the pinion *h* is fixed a wheel *i*, which works into a pinion *j*; on the axis of the pinion *j* is fixed a wheel *k*, which works into a pinion *l*; on the axis of the pinion *l* is fixed a wheel *m*, which works into a pinion *n*, on the axis of which is fixed the escape wheel *o*; *p* is the balance, *q* the cock, or part which supports the upper pivot of the balance.

The parts about to be described are in addition to those of a watch. The other end of the axis of the balance *p* passes through the back and front plates *w* and *r*, (see fig. 3,) and on this axis is fixed another wheel *s*, (which is also shown by dotted circles in fig. 1), similar to the balance *p*, but less in diameter; and on the front end of the axis is fixed the hand *f*, which vibrates along with the balance.

The edge of the wheel *s* is rough, having very minute teeth (made with a milling tool) against which acts a very weak spring *t*, which shews the way that the wheel *s* and also the hand *f* were turning at the instant they were stopped; the end of the spring *t* is seen through a hole *u*, in the front of the dial plate, (see fig. 1) the end of the spring which is in contact with the edge of the wheel *s* is bent downwards by the motion of the wheel, which indicates that the hand *f* was passing from 0 to 50 when stopped, counting the numbers on the inside of the arc *e*; but should the end of the spring *t* have been bent upwards, as represented by the dotted line, it would have shown that the hand *f* was passing from 0 to 10, counting the numbers on the outside of the arc *e*; therefore it may be easily ascertained in what direction the hand *f* was moving when stopped, by examining the direction of the end of the spring *t*. The balance *p* is stopped by the action of a double spring or gripe *v*, which is fixed to the back-plate *w*, by the screw *x*.

Figs. 4 and 5 are side and edge views of the gripe *v*, which is made of brass and well hammered; the two sides act as springs pressing on each other, the bent ends of which pass above and below the balance *p*, and gripe it so as to stop its motion instantaneously; *y* is an axis which passes through and turns in the back and front plates *w* and *r*, on the upper end of which is fixed an arm *z*. At the end of this arm a piece projects, which is made of a wedge shape, to an angle of about 60 degrees, the point of which enters the end of the slit between the sides of the gripe *v*; on the middle part of the axis, between the plates, is formed another arm or lever A, the motion of which is limited between two pins, 1 and 2, which are fixed in the plate *r*; B is a stud, the neck of which passes through a hole in the side of the case, and is fixed in the end of the lever A; consequently, when the stud B is pressed inwards by the thumb, the wedge at the end of the arm *z* is at the same time pressed between the ends of the gripe *v*, and releases the balance, which will remain in motion till the thumb is removed, when the spring of the gripe will press back the wedge *z*, and the balance will be instantaneously stopped: on the other end of the axis *y*, between the plate *r* and the dial plate, is fixed a third arm C; in the end of it is fixed the bent spring *t*, the use of which has already been described; it will also be observed, when the stud B is pressed inwards to the stop 1, the end of the spring *t* will be just clear of the edge of the wheel *s*, so as not to retard its motion; but when the thumb is removed, the spring will act against the edge of the wheel, before the gripe stops the balance, which will cause the end of the spring *t* to be bent as before described.

The figs. 6 and 7 are two views of the axis *y*, and its arms *z*, A and C, &c.

This instrument is found to be of great importance in measuring the velocity of sound.

Suppose an observation is to be made on the report of a cannon, the observer must be placed in a situation that he can see the flash of the gun, and at as great a distance as can conveniently be measured; the instrument must then be wound up, in a similar manner to a watch; the time, or the position of the three hands must be marked down, the observer must place his thumb lightly upon the stud B, and wait until he sees the flash of the cannon, then he must press forward the stud B, and keep it in that position till he hears the report; when the thumb must be removed instantaneously, which causes the instrument to stop immediately; the hands will then point out the length of time between seeing the flash, and hearing the report; the distance being then measured, the velocity will be ascertained.

The spring, which by its position shows the direction in which the index *f* has been traversing, was invented by Mr. Hardy in making the model for the Society. The instruments, therefore, which were constructed before that period are without this very useful addition.

No. XVI.

STRIKING PART OF A QUARTER CLOCK.

The sum of TWENTY GUINEAS *was this session given to Mr. J.* AITKIN, *55, St. John-street, Smithfield, for his improvements in the Striking Part of a Quarter Clock. A model of the invention has been placed in the Society's repository.*

THE parts of a clock concerned in striking the hours and quarters have generally been very complicated, and, of course, liable to be put out of order. Mr. Aitkin, by a novel and very ingenious adaptation of each piece to different uses, has succeeded in greatly reducing their number, as will appear by the following detailed description.

Plate XIII. is a front view of the plate and motion work of a quarter clock, having the dial-plate removed.

Plate XIV. represents a view of the front and upper edge of the several parts in detail.

The same letters refer to the same parts in both plates.

a a is the front plate, or part of the frame to which the motion work is attached.

The train or wheel work is nearly similar to that of the common quarter clock; the diameters of the wheels and